

# PATENT SPECIFICATION

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NO DRAWINGS.

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## COMPLETE SPECIFICATION.

### Surface Condensers for Steam and Other Vapours.

We, SERCK TUBES LIMITED, of Warwick Road, in the City of Birmingham 11, a British Company, do hereby declare the invention, for which we pray that a patent 5 may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to surface condensers for steam or other vapours and has as 10 an object the provision of a condenser in a convenient form.

In accordance with the invention a surface condenser is provided, on those 15 surfaces on which condensation occurs in use, with a thin coating of a fluorocarbon synthetic resin material which is not wettable by the condensate.

A suitable synthetic resin material for 20 this purpose is poltetrafluoroethylene (hereinafter referred to as p.t.f.e.).

The invention also resides in a cooling element adapted to form a part of a condenser as above defined, said element being 25 coated on at least one side with p.t.f.e. or a fluorocarbon synthetic resin material having similar wettability. Such a cooling element may be in the form of a tube which is coated externally or a plate.

30 In an example of the invention a surface condenser is generally of known construction and includes a plurality of metal tubes through which cooling liquid is, in use, caused to flow. The external surface of each 35 tube is coated with an extremely thin layer of p.t.f.e. or a similar fluorocarbon synthetic resin material. Such a coating may be applied by chemically treating the surface of the metal tube to form a porous surface structure. Such structure may then be in 40 the form of an oxide film. Alternatively selective etching techniques may be em-

ployed. Alternatively the porous surface structure may be formed by spraying or sintering a porous metal coating onto the tube. The p.t.f.e. is then applied to the surface structure and some or all of the p.t.f.e. may be absorbed. On sintering, the dispersed particles of p.t.f.e. are united to form a combined structure of porous metal and p.t.f.e. The thickness of the p.t.f.e. coating is preferably not in excess of 5 microns.

In use it has been found that condensation takes place on the coated surfaces in droplets rather than in a film. Thus the efficiency of the condenser is enhanced considerably. Since the p.t.f.e. coating is of extreme thinness, the increase in thermal resistance is not significant compared with the gain in efficiency owing to the dropwise condensation. It may be desirable to make the p.t.f.e. coating thinner than the porous surface structure which itself is preferably less than 5 microns thick.

Where the coolant is likely to leave 55 deposits of sludge and other foreign matter within the tubes, these may be coated with p.t.f.e. or the like internally as well as externally.

The invention can also be applied to condensers of the plate type in which a plurality of ported metal plates are sealingly connected together to provide between them alternate flow passages for the vapour and for the coolant. In this case at least the 60 sides of the plates which are exposed to the vapour would be coated, although both sides of each plate may be coated if desired.

Our copending application No. 11620/64 (Serial No. 1,042,387) of even date relates to 65 the use of coatings of fluorocarbon synthetic resin material in heat exchangers.

[Price 4s. 6d.]

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## WHAT WE CLAIM IS:—

1. A surface condenser which is provided, on those surfaces on which condensation occurs in use, with a thin coating of a fluorocarbon synthetic resin material which is not wetted by the condensate. 5

2. A condenser as claimed in claim 1 including cooling elements on which said coating is provided. 10

3. A condenser as claimed in claim 2 in which said cooling elements are in the form of tubes. 15

4. A condenser as claimed in claim 2 in which the cooling elements are in the form of plates. 15

5. A condenser as claimed in any one of claims 2 to 4 in which the coating is formed by treating the surface of the cooling elements to provide a porous surface structure and then applying the coating to said surface structure so that at least part of the coating material is absorbed thereby. 20

6. A condenser as claimed in claim 5 in which the coating material is applied in dispersion and is subsequently sintered. 25

7. A condenser as claimed in claim 5 or 6 in which the porous surface structure is in the form of a non-metallic film. 30

8. A condenser as claimed in claim 7 in which the film is an oxide film. 30

9. A condenser as claimed in claim 5 or 6 in which the porous surface structure is formed by adding a layer of porous metal. 35

10. A condenser as claimed in claim 9 in which said added metal layer consists of sintered metal. 35

11. A condenser as claimed in claim 9 in which the added metal layer is formed by metal spraying. 40

12. A condenser as claimed in claim 5 or 6 in which the porous surface structure is formed by selective etching. 40

13. A condenser as claimed in any one of claims 5 to 12 in which the porous surface structure has a thickness of less than 5 microns. 45

14. A condenser as claimed in any one of claims 5 to 13 in which the coating has a thickness of less than 5 microns. 50

15. A condenser as claimed in claim 14 in which the thickness of the coating is less than the thickness of the porous structure. 50

16. A condenser as claimed in any preceding claim in which the fluoro carbon resin material is polytetrafluoroethylene. 55

17. A condenser as claimed in any one of claims 2 to 16 in which each cooling element is also coated on its cooled surface with polytetrafluoroethylene or a similar fluoro carbon resin material. 60

18. A cooling element adapted to provide a condensing surface of a condenser as claimed in any preceding claim and coated on at least one surface with polytetrafluoroethylene or a fluorocarbon synthetic resin material having similar wettability. 65

19. A cooling element as claimed in claim 18 in the form of a tube which is coated externally. 70

20. A cooling element as claimed in claim 19 in which the tube is also coated internally. 70

21. A cooling element as claimed in claim 20 in the form of a plate coated on one or each surface. 75

22. A surface condenser substantially as hereinbefore described. 75

23. A cooling element for use in the construction of a surface condenser substantially as hereinbefore described. 80

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